

Incidentally detected breast lesions on chest CT with US correlation: a pictorial essay

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ABSTRACT

With the increasing use of computed tomography (CT), incidental breast lesions are detected more frequently. When interpreting chest CT findings, it is important for radiologists to carefully review the breast to recognize any abnormal findings that could affect patient management. The purpose of this study is to discuss incidental breast lesions on chest CT with ultrasonography correlation that may be encountered in routine clinical practice.

Although chest computed tomography (CT) usually covers the whole breast tissue, it is not the primary method for the evaluation of the breast. Chest CT has the drawback of exposing breasts to radiation. Inoue et al. (1) reported that the radiation dose at the skin surface of the breast during CT scanning was approximately ten times greater than the dose received during standard mammography.

However, recent studies have reported the importance of chest CT for the detection of unexpected breast lesions (2–8). These breast lesions may include primary and secondary malignancies, as well as benign lesions, including benign calcification, fibroadenomas, and lipomas (2–4). Sometimes, CT may be the first modality to demonstrate a new primary breast cancer (5). In recent literature, the prevalence of breast cancers among incidental lesions detected using CT varied from 24% to even 70% (6–8). Therefore, it may be important for radiologists to pay attention to the breast during routine chest CT examinations.

In this pictorial essay, we illustrate incidental breast lesions that are encountered while interpreting chest CT in our institution. For each lesion that was originally detected by CT, ultrasonography (US) findings are also presented.

Benign breast lesions

Fibrocystic changes

The term “fibrocystic changes” has been used to refer to various histologic conditions, ranging from normal physiologic changes to true premalignant proliferations of breast tissue (9). Imaging features of this condition are variable. US usually shows an iso- to hypoechoic solid nodule with a round or oval shape (10). To our knowledge, there have been no documented features of fibrocystic changes on CT. However, CT may reveal an oval or round mass that eventually requires biopsy (6) (Fig. 1).

Fibroadenoma

Fibroadenomas are the most common benign breast tumors that occur during the reproductive period. In most cases, US shows an oval mass with circumscribed margin, hypoechogenicity, and parallel appearance (9). However, US findings may be variable, sometimes indistinguishable from cancer. On CT, fibroadenomas appear as either a calcified or noncalcified nodule with well-defined margins (2). Many fibroadenomas undergo hyalinization, calcification, and atrophy over time, although the relationship of these findings with menopause is unclear (9). When densely calcified, fibroadenomas exhibit a pathognomonic appearance of popcorn-shaped large calcifications on both mammography and CT, which is representative of benign calcification (4, 9) (Fig. 2).

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Chronic granulomatous inflammation

Chronic granulomatous inflammation is a rare inflammatory disease of the breast and a diagnosis of exclusion. Other granulomatous diseases such as Wegener's granulomatosis, sarcoidosis, tuberculosis, brucellosis, or other fungal or parasitic infections should be ruled out (11). This often affects younger women with a recent history of pregnancy (11), and manifests as a unilateral firm breast lump similar to the presentation of breast cancer (12). US shows a hypoechoic lesion with an irregular shape and indistinct margin, sometimes associated with axillary lymphadenopathy. On CT, it may appear as a heterogeneously enhancing lesion associated with prominent skin thickening (13) (Fig. 3).

Hematoma

Breast hematomas can develop after biopsy, trauma, or surgery (3). Hematomas present as high-attenuation fluid collections but sometimes form mass-like lesions with architectural distortion and could be mistaken for other breast tumors (2). Clinical history and follow-up imaging studies help in establishing a diagnosis, as hematomas will regress over time (3). US is the mo-

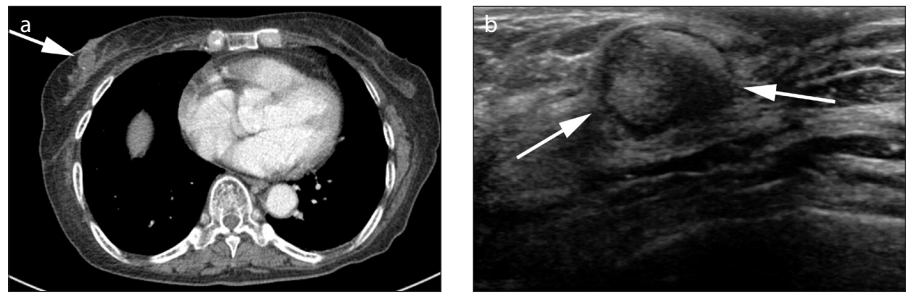


Figure 1. a, b. A 64-year-old woman who complained of cough and sputum and underwent chest computed tomography (CT). Contrast-enhanced axial CT image (a) shows a nonenhancing, smooth, oval mass with focal calcification in the right breast (arrow). Ultrasonography (US) image (b) shows a hyperechoic mass with a circumscribed margin and oval shape in the right subareolar area (arrow). The mass was confirmed as a fibrocystic change following US-guided core needle biopsy.

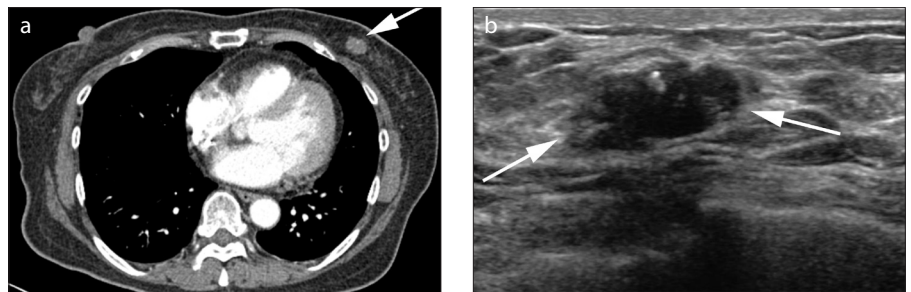


Figure 2. a, b. A 56-year-old woman with colon cancer underwent chest CT for preoperative evaluation. Contrast-enhanced axial CT image (a) shows an oval mass with heterogeneous enhancement and focal internal calcification in the left breast (arrow). US image (b) shows a hypoechoic mass with an indistinct margin, oval shape, and calcification (arrow). The mass was determined to be a fibroadenoma following US-guided core needle biopsy.

Main points

- Recent studies have reported the importance of chest CT for the detection of incidental breast lesions. These breast lesions may include primary and secondary malignancies, as well as benign lesions, including benign calcification, fibroadenomas, and lipomas.
- When densely calcified, fibroadenomas exhibit a pathognomic appearance of popcorn-shaped large calcifications on both mammography and CT, which is representative of benign calcification.
- A spiculated mass with irregular margins, irregular shape, and various enhancement patterns are known to be the most reliable morphologic predictors of malignancy, as well as skin thickening, axillary lymphadenopathy, invasion of the pectoralis muscle, and pleural effusions.
- Axillary lymphadenopathy is one of the characteristic findings of lymphoma, and it should be highly considered in the differential diagnosis when there are large axillary lymph nodes without evidence of primary breast cancer.
- Although CT may not provide information for a definitive diagnosis, it can act as a useful imaging tool for the breast, which ultimately alters patient management and leads to further evaluations.

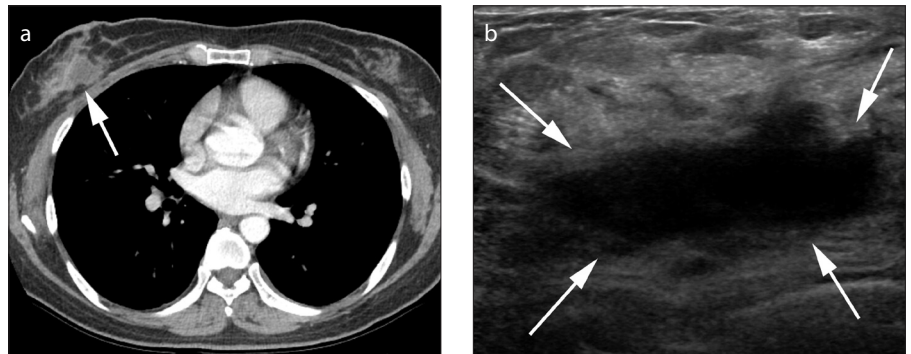


Figure 3. a, b. A 45-year-old woman who complained of chest pain and underwent chest CT. Contrast-enhanced axial CT image (a) shows an ill-defined mass with an irregular shape and heterogeneous enhancement in the right breast (arrow). US image (b) shows a hypoechoic mass with an irregular shape and indistinct margin (arrows) in the right breast. The mass was confirmed to be chronic granulomatous inflammation following US-guided core needle biopsy.

ality of choice to evaluate the internal fluid content of the hematoma (4). On CT, the margins of hematomas are usually well-circumscribed, but they may be ill-defined or even spiculated due to the reactive and fibrotic changes that can occur during the healing process of the lesion (2, 4) (Fig. 4).

Interstitial mammoplasty

Direct injection of silicone or paraffin into the breast was frequently performed for

augmentation in the past (14). As a result, granulomas and calcifications can develop in women who have undergone interstitial mammoplasty. Fibrous silicone breast granulomas usually appear as well-defined, round, dense or peripherally calcified nodules, whereas paraffinomas exhibit streaky opacities, parenchymal distortion, and dystrophic ring calcifications (2, 4). On US, these foreign body granulomas present as diffuse acoustic shadowing (i.e., a snowstorm ap-

pearance), obscuring the underlying breast parenchyma (14). On CT, they may be seen as coarse calcifications (2) (Fig. 5).

Accessory breast tissue

Breast tissue can exist anywhere along the “milk line,” from the axilla to the groin. Accessory breast tissue refers to additional glandular tissue that extends unilaterally or bilaterally from the main gland (4). The imaging findings do not differ from those of normal glandular tissue, most commonly appearing as a homogeneous soft tissue lesion on CT (4) (Fig. 6). Despite the benign appearances of the lesion, radiologists should be cautious in its interpretation, as breast cancer can develop in the accessory breast tissue (4).

Gynecomastia

Gynecomastia is the most common abnormality of the male breast which is caused by proliferation of ductal and stromal tissues, resulting in non-neoplastic breast enlargement (15). Patients with gynecomastia usually present with a palpable lump, breast pain, or breast enlargement (15). It has a bimodal age distribution with the highest peak during puberty and a second peak around 50 years of age (4, 15). It is associated with various causes including endogenous hormonal imbalances, liver cirrhosis, renal disease, hyperthyroidism, paraneoplastic syndrome, and exogenous drug use (4, 15). On US, gynecomastia appears as discoid or “flame-shaped” hypoechoic tissue in the subareolar region (4). It can be seen on CT as, symmetric or asymmetric soft tissue density in the subareolar areas, similar to findings of the female breast (4) (Fig. 7).

Malignant breast lesions

Invasive ductal carcinoma

Invasive ductal carcinoma (IDC) is the most common breast cancer type. There have been numerous studies determining the CT imaging features of IDC that are predictive of malignancy. A spiculated mass with irregular margins, irregular shape, and various enhancement patterns are known to be the most reliable morphologic predictors of malignancy, as well as skin thickening, axillary lymphadenopathy, invasion of the pectoralis muscle, and pleural effusions (2–8). However, microcalcifications and ill-defined margins appear to be diagnostically unhelpful on CT (6). US may reveal an irregular, indistinct, hypoechoic mass, frequently with acoustic shadowing (2–4, 9) (Fig. 8).

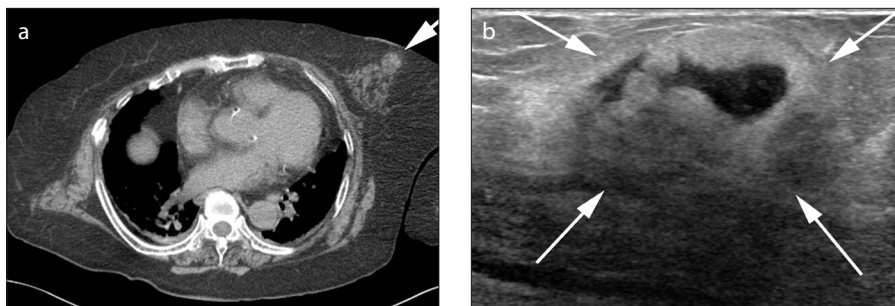


Figure 4. a, b. A 75-year-old woman who slipped and fell eight days prior to undergoing chest CT for fever, chills, and mental status change. Contrast-enhanced axial CT image (a) shows an ill-defined mass with an oval shape and heterogeneous enhancement in the left breast (arrow). US image (b) shows a complex echogenic mass with indistinct margin (arrows) in the subcutaneous layer in the left upper breast.

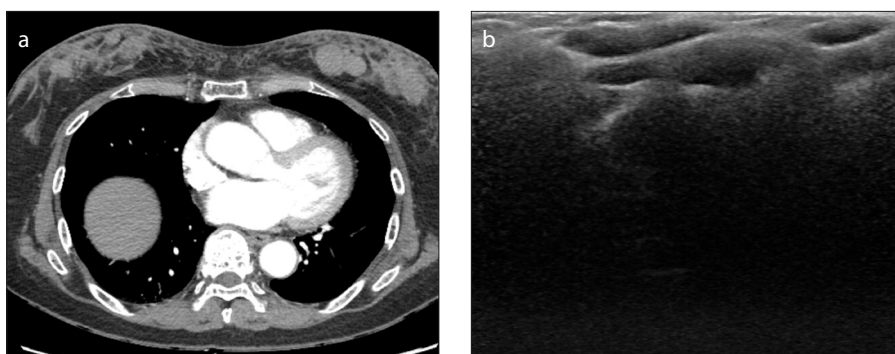


Figure 5. a, b. A 58-year-old woman with multiple myeloma who underwent chest CT for observation. Contrast-enhanced axial CT image (a) shows multiple, nonenhancing nodules in both breasts with overlying skin thickening. US image (b) shows diffuse acoustic shadowing by innumerable foreign body materials.

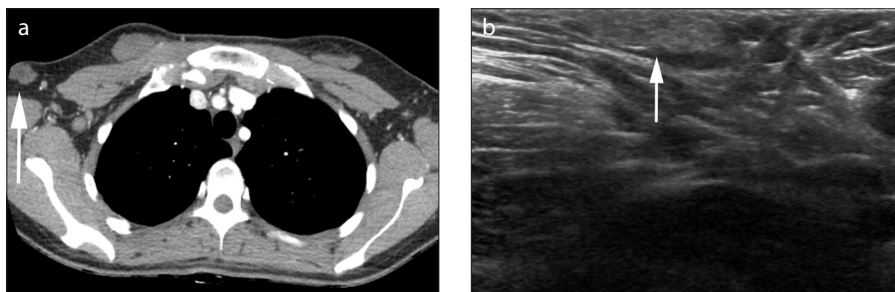


Figure 6. a, b. A 44-year-old woman who complained of chest pain after recent trauma and underwent chest CT. Contrast-enhanced axial CT image (a) shows an oval mass with a lobulated margin and heterogeneous enhancement in the right axilla (arrow). US image (b) shows accessory breast tissue in the right axilla without any internal abnormalities (arrow).

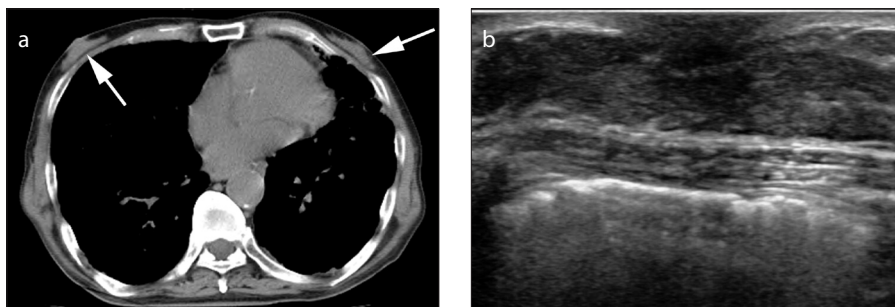


Figure 7. a, b. A 68-year-old man with a history of pneumoconiosis who complained of right breast pain with a palpable mass. Unenhanced axial CT image (a) shows prominent soft tissue densities in both subareolar regions (arrows). US image (b) shows large discoid hypoechoic lesions in both subareolar regions. The patient was diagnosed with fibrocystic change consistent with gynecomastia following US-guided core needle biopsy of the right breast.

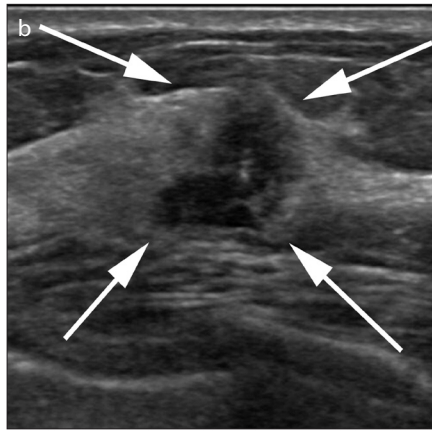
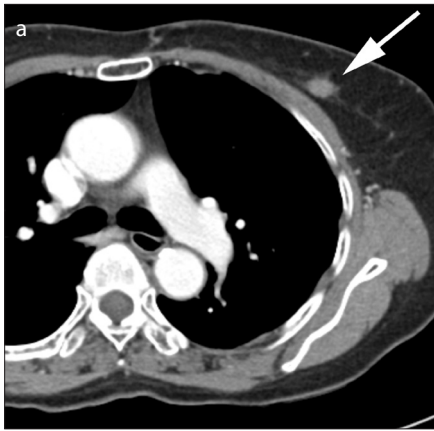


Figure 8. a, b. A 76-year-old woman diagnosed with acute cholecystitis who underwent chest CT because of a preoperative chest X-ray abnormality. Contrast-enhanced axial CT image (a) shows an oval mass with hyperenhancement in the left breast (arrow). US image (b) shows a hypoechoic mass with an indistinct margin and irregular shape (arrows). The mass was confirmed to be an invasive ductal carcinoma following US-guided core needle biopsy.

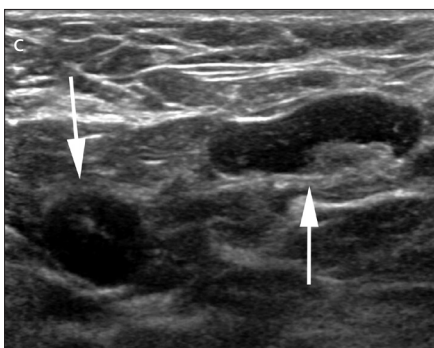
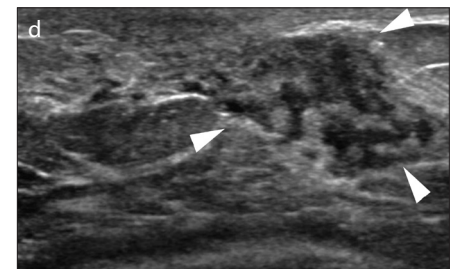
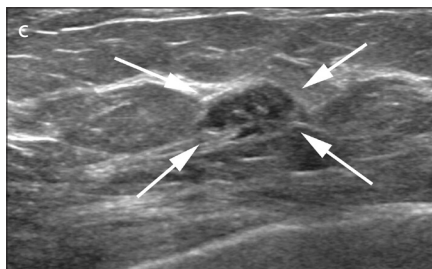
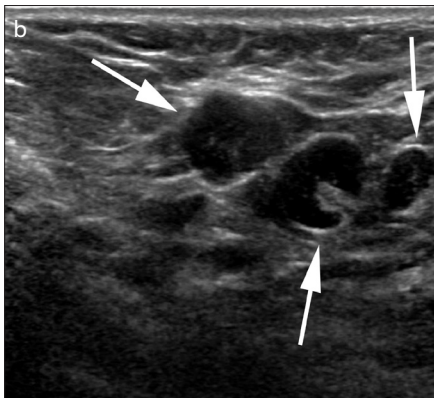
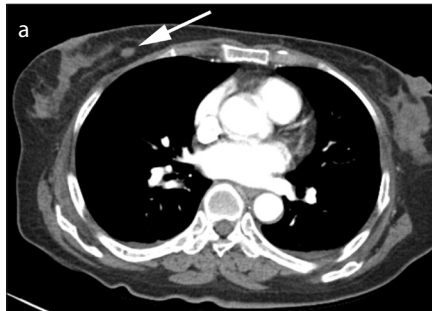


Figure 9. a–c. A 76-year-old man who underwent chest CT for dyspnea. Contrast-enhanced axial CT image (a) shows several enlarged lymph nodes in both axillae (arrows). US images (b, c) show multiple enlarged lymph nodes with cortical thickening in both axillae. US-guided core needle biopsy revealed lymphoproliferative disease. The patient subsequently underwent excisional biopsy, and low-grade B cell lymphoma was diagnosed.

Figure 10. a–d. A 64-year-old woman who complained of low back pain and underwent chest CT for a malignancy work-up. Contrast-enhanced axial CT images (a, b) show an oval nodule with a smooth margin in the right inner breast (arrow) and an ill-defined mass with irregular shape in the left subareolar area (arrowheads). US images (c, d) show a hypoechoic mass with microlobulated margin and oval shape in the right inner central breast (arrows) and an irregular ductal dilatation in the left subareolar area (arrowheads). Anaplastic large cell lymphoma was diagnosed following US-guided core needle biopsy.

Lymphoma

Lymphoma of the breast occurs primarily or secondarily as a metastatic lesion. It is an unusual disease entity that can manifest as single or multiple discrete nodules or as diffuse parenchymal thickening (2, 3, 9). Axillary lymphadenopathy is one of the characteristic findings, and lymphoma should be considered when there are large axillary lymph nodes without evidence of primary breast cancer (3) (Fig. 9). US can show a rather nonspecific hypoechoic nodule that often mimics IDC (9). On CT, breast lymphoma presents as either a well-defined or ill-defined mass with irregular shape (2) (Fig. 10).

Metastasis

Metastases to the breast from non-mammary origins are encountered infrequently. Excluding contralateral breast cancers, sarcomas, and lymphomas, the most common primary tumor that metastasizes to the breast is melanoma, followed by lung cancer, carcinoid tumor, stomach cancer, ovarian cancer, renal cell carcinoma, colon cancer, and cervical cancer (2, 4, 9). The incidence of metastatic breast tumors is higher in women (2, 4). It may be difficult to differentiate metastatic disease from primary breast cancer by imaging, especially by CT. However, metastatic lesions are more likely to be multiple, are

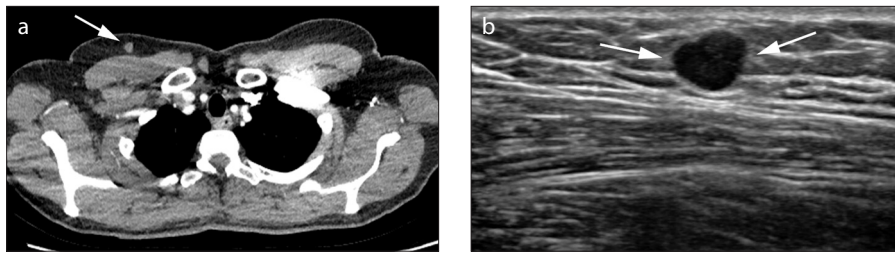


Figure 11. a, b. A 41-year-old woman, who had been diagnosed with melanoma in the skin of right medial knee and a right inguinal lymph node, complained of a palpable mass in the right upper chest wall. She underwent chest CT for a metastasis work-up. Contrast-enhanced axial CT image (a) shows a round enhancing nodule with a smooth margin in the right upper breast (arrow). US image (b) shows a hypoechoic mass with circumscribed margin and oval shape in the right upper outer breast (arrows). A diagnosis of malignant melanoma was made following US-guided core needle biopsy.

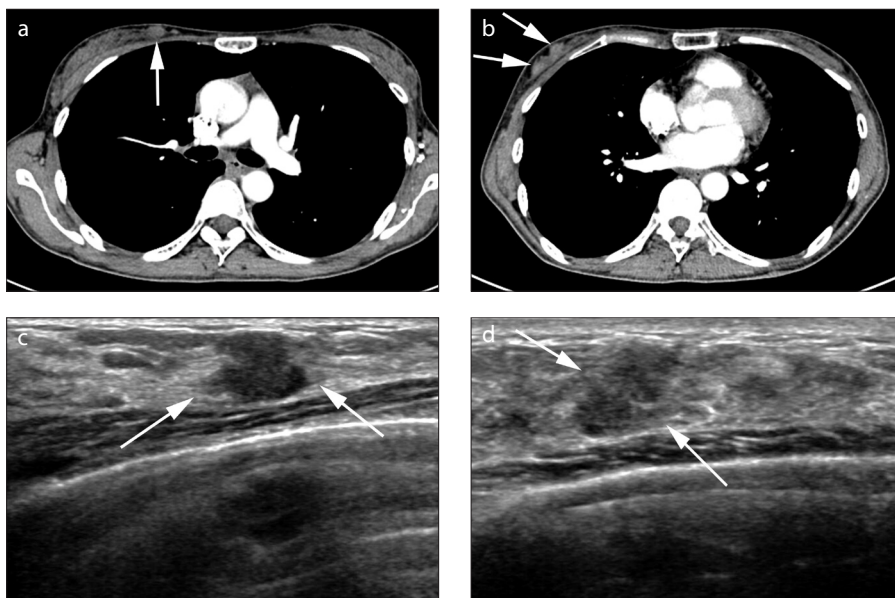


Figure 12. a–e. A 43-year-old woman who had been diagnosed with advanced gastric cancer and Krukenberg tumor was admitted to the hospital because of multiple metastatic seeding masses in the abdominal cavity. She underwent chest CT for a metastasis work-up. Contrast-enhanced axial CT images (a, b) show multiple enhancing lesions with irregular shapes and ill-defined margins in both breasts (arrows). US images (c–e) show multiple irregular, hypoechoic masses with indistinct margins in both breasts (arrows). US-guided core needle biopsy was performed in two of the lesions in the right lower central breast (d) and left upper outer breast (not shown). The diagnosis was poorly differentiated carcinoma metastasized from gastric adenocarcinoma.

frequently bilateral, and are superficially located (2, 4, 9). On US, metastatic tumors manifest as round, oval, or irregular shapes with various internal echoes and normal or increased posterior acoustic enhancement (2, 9) (Figs. 11, 12).

Conclusion

Incidental breast lesions are often detected on chest CT, but sometimes these are overlooked or not evaluated thor-

oughly in daily practice. Although CT may not provide information for a definitive diagnosis, it can act as a useful imaging tool for the breast, which ultimately alters patient management and leads to further evaluations. It is important for radiologists to evaluate the breast carefully, even on routine chest CTs obtained for other thoracic indications.

Conflict of interest disclosure

The authors declared no conflicts of interest.

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